CINCAD SPACE SHUTTLE SUPPORT

IMPLEMENTATION PLAN 3410-31

February 1981

Approval:

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Item 44

DOCUMENT REVIEW COMMENTS

Date: 19 Aug 81 — Page 1 of 1 Pages

CINCAD Space Shuttle Support IPLAN 3410-81

TO: N/J-3X — FROM: Lt Hinkle — N/J32C — 6277

PAGE NO.	PARAGRAPH(S)	COMMENTS
1	Appendix I	Change "CFT-1" to "OFT-2"
	General	Standardize terms. Use "OFT" throughout text rather than "STS" or vice versa.
10	T + 11	65
11	T + 46	
12	Line 2	
12	Line 8	
13	Line 2	
26	Line 1	Capitalize all message precedences. Change "Flash" to "FLASH"
27	Line 5	Change "Flash" to "FLASH"
28	¶ 5	Change "Flash" to "FLASH"
50	Line 6	Change the duty number for N/J-3X to "3004"
[illegible]	Under "Other"	Add "ESMC/ROPN Patrick AFB FL - 2 copies" "NORAD ALCOP Malmstrom AFB MT - 3 copies" [illegible]

NORAD Form 21 Aug 80

TABLE OF CONTENTS

SECTION I - OPERATIONAL CONCEPT

This Implementation Plan is published in accordance with CINCAD OPLAN 3410-81. This plan shall be in effect throughout the life of all Space Shuttle missions. The plan is unclassified; however, its contents shall not be disclosed outside official channels without approval from the Chief, Space Operations Directorate, Cheyer e Mountain Complex, CO.

Specific duties, responsibilities, actions, and interfaces are identified, and are effective upon receipt of this document. This plan

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is intended to provide overall guidance and direction to individuals directly involved in providing ADCOM support to the Space Shuttle. Changes to the above shall be provided/approved by the Chief, Space Operations Directorate, through the issuance of Fragmentation Orders.

Refer any comments/questions on this plan to the Chief, Space Operations Directorate, A/J-3Y, Cheyenne Mountain Complex, CO 80914. AUTOVON 834-1211, Ext. 3510, or Commercial (303) 473-4010, Ext. 3510.

[illegible]

SECTION II - ACRONYM LISTING

ADCOM	Aerospace Defense Command
AOA	Abort Once Around
ARIS	Advanced Range Instrumentation Ship
ASC	Ascension
ASCC	Alternate Space Computation Center (Eglin AFB, Fla.)
ATO	Abort to Orbit
BCF	Backup Computational Facility (NAVSPASUR, Dahlgren, VA)
CD	Command Director
CLS	Contingency Landing Site
COMBO	Computation of Miss Between Orbits (SCC program)
D/O	Deorbit
EAFB	Edwards Air Force Base.
EGL	Eglin AFB, Fla.
EODET	Early Orbit Determination
ET	External Tank
FD	Flight Director (JSC)
FDO	Flight Dynamics Officer (JSC)
FTC	Flight Termination Conference
ILAM	Initial Launch Alert Message
IOMODX	SCC program for generating Initial Orbits via vectors.
JSC	Johnson Spaceflight Center

J-3Y	Space Operations Directorate (NCMC)
J-3T	Space and Missile Warning Training Directorate (NCMC)
J-3V	Space and Missile Warning Standardization/ Evaluation Directorate (NCMC)
J-3YY	Space Analysis and Data Division (NCMC)
KSC	Kennedy Spaceflight Center
L&I	Launch and Impact
LCHE	Launch Event Record
LCU	Launch Correlation Unit (NCMC)
LCUDO	Launch Correlation Unit Duty Officer (NCMC)
MECO	Main Engine Cut-Off
MOCR	Mission Operations Control Room (JSC)
MW	Missile Warning
MWO	Missile Warning Officer (NCMC)
NASA	National Aeronautics and Space Administration
NAVSPASUR	Naval Space Surveillance System (Dahlgren, VA)
NCMC	NORAD Cheyenne Mountain Complex
NFL	New Foreign Launch
OAL	Orbital Analyst Leader (NCMC)
OFT	Orbital Flight Test
OMS	Orbital Maneuvering Subsystem
OPREP	Operations Report
OV	Orbiter Vehicle
PASCHED	Pass Schedule (SCC program)
PPLF	Pre-Planned Launch Folder

PPE	Pave Paws East
PPW	Pave Paws West
PREDICT IMPACT	SCC program used to predict impact points for decaying satellites
RCO	Range Control Officer (KSC)
RTLS	Return to Launch Site
SCC	Space Computation Center (NCMC)
SDA	Space Defense Analyst (NCMC)
SDD	Space Defense Director (NCMC)
SEWS	Satellite Early Warning System
SPADOC	Space Defense Operations Center (NCMC)
SRB	Solid Rocket Boosters
SSC	Space Surveillance Controller (NCMC)
SST	Space Surveillance Technician (NCMC)
SVO	Surveillance Officer (NCMC)
TEARR	Time, Elevation, Azimuth, Range, and Range Rate
TIP	Tracking and Impact Prediction

SECTION III - EXECUTION CHECKLIST

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Timing[1]	Action/Event	Headquarters/ Agency

A. PRE-LAUNCH:

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Timing	Action/Event	Headquarters/ Agency

b5

Timing	Action/Event	Headquarters/ Agency

b5

Timing	Action/Event	Headquarters/ Agency

b5

Timing	Action/Event	Headquarters/ Agency

b5

B. LAUNCH:

b5

Timing	Action/Event	Headquarters/ Agency

b5

C. ON-ORBIT:

b5

Timing	Action/Event	Headquarters/ Agency

b5

Timing	Action/Event	Headquarters/ Agency

65

Timing	Action/Event	Headquarters/ Agency

b5

D. DEORBIT/LANDING:

b5

Timing	Action/Event	Headquarters/ Agency

b5

SECTION IV - RESPONSIBILITIES

The following agencies are tasked with the stated responsibilities to insure CINCAD OPLAN 3410-81 support is consistent for all STS flights:

A. J-3V: The Space and Missile Warning Standardization/Evaluation Directorate must certify that all SCC operational crews are operationally ready to support STS flight

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B. J-3T: The Training Directorate is responsible for exercising these crews on a regular basis, insuring they have up-to-date information on STS flight profiles and capabilities, and insuring currency in the crews' ability to support each STS flight.

C. J-3YY: The Space Analysis and Data Division is responsible for

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assisting J-3T in crew exercises, disseminating information from NASA to ADCOM personnel, and for augmenting the SCC operational crews for STS activities when necessary.

D. SDD: The Space Defense Director is responsible for providing the appropriate space defense warning should the OV be subjected to potential threat activities.

E. SSC: The Space Surveillance Controller is responsible for supervising activity in the SCC, assuring all ADCOM support requirements are met, and maintaining the interface between the SCC and the JSC Mission Operations Control Room (MOCR).

F. SST: The Space Surveillance Technician is responsible for sending the alert and liftoff messages to appropriate sensors and assisting the SSC in monitoring SCC activity and support during the STS flight.

G. SVO: The Surveillance Officer is responsible for establishing and maintaining communications with necessary agencies, determining sensor status, and obtaining EODET data.

H. LCUDO: The Launch Correlation Unit Duty Officer is responsible for meeting the requirements of current directives and providing contingency support as outlined in this Implementation Plan.

I. MWO: The Missile Warning Officer is responsible

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to provide event correlation whenever possible. b5

J. OAL: The Orbital Analyst Leader is responsible for familiarizing himself with each STS flight profile, providing the analytical support for JSC and assisting the SSC in monitoring support requirements.

K. ASCC/BCF: The ASCC and the BCF will operate in parallel with the SCC

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These two agencies should develop their own in-house procedures to comply with the intent of the previous statement. The SCC will relay all pertinent events, information, and appropriate state vectors to the ASCC and BCF. All TIP and COMBO products will be transmitted to the SCC only.

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SECTION V - CONTINGENCY CHECKLISTS

Operations has addressed the possibility of several contingencies which ADCOM could be tasked to support. With the exception of COMBO support and External Tank TIP support, contingency support has not been requested by NASA but has been preplanned by ADCOM in the event additional support is requested on very short notice. The following specific contingencies are discussed:

- Computation of Miss Between Orbits (COMBO)
- Anomalous Liftoff
- MECO Overburn/Overspeed
- Anomalous OMS Burns
- "Events" during OV flight
- Anomalous Reentry of OV
- [illegible] Outage
- Radar Tracking Restriction

A. PRE-LAUNCH:

COMBO:

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The SSC should use good judgment in determining the validity of all COMBO runs. The intent of ADCOM COMBO support is to provide JSC with valid conjunction information throughout the mission profile. For example, a one second change in launch time or maneuver time could result in conjunction errors of approximately 10 km or more. The SSC may obtain new state vectors from JSC/FDO whenever the SCC maintained element set is in question. This is particularly true during any OMS maneuvers or prior to publication of an element set. The SSC should direct the OAL to rerun any COMBO of questionable validity or to run a new COMBO if the SSC or OAL think it warranted. The SSC should then pass any new results to JSC/FDO.

B. LAUNCH:

Anomalous Liftoff:

An anomalous liftoff could result in a Return-to-Launch-Site (RTLS), or a splashdown in the Atlantic Ocean.

SUPPORT: Because the RTLS and splashdown contingencies occur very early in the mission profile (after SRB staging), ADCOM support will be minimal. The SSC will insure that the EODET conferees are immediately advised of any contingency condition. The Initial Launch Alert Message will contain specific tasking instructions to cover these contingencies.

CHECKLIST:

RTLS or Splashdown:

1. b5

External Tank Overspeed:

Any External Tank Overspeed caused by a MECO overburn is a condition that has received a great deal of consideration by both NASA and ADCOM. MECO and ET separation constitute a critical phase in the flight profile.

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Speculation exists as to how much time past the nominal burn would be required to move the ET impact past the Indian Ocean and nearer to the western CONUS. An overburn of one second is generally thought to be this minimum time required. This short overburn becomes even more important when coupled with the reasonably high possibility that the condition may occur during the actual flight. This anomalous separation could cause the ET to attain a much higher ballistic trajectory or even a fractional/multiple orbit which could result in an elongated footprint and a b5

The same contingency could result from an overspeed condition if upon separation the ET is imparted a greater velocity than planned. Even a nominal separation may put the ET impact in an area other than the projected Indian Ocean footprint.

SUPPORT: Because of the possibility of an anomalous ET reentry, b5

If the ET should extend ballistic flight and approach the CONUS, the MWO will forewarn the MW network as to the nature of the reentry. Appropriate sensors will track the ET and generate L&Is. b5

CHECKLIST:

EXTENDED BALLISTIC TRAJECTORY:

1. b5

2. b5

Should the ET attain a fractional or multiple orbit, all acquiring sensors should send their data Flash precedence to the SCC. The OAL will then run PREDICT IMPACT.

b5

FRACTIONAL OR MULTIPLE ORBIT:

1. b5

2. b5

3. b5

C. ON-ORBIT:

Anomalous OMS Burns:

Orbital Maneuvering Subsystem (OMS) burns occur at four separate phases of the mission profile. A bad burn at any one of these phases could affect the rest of the mission profile from that point. Therefore, each burn should be monitored by the SSC and tracking data obtained during, or as soon as possible after, the burn. The actions for any anomalous OMS burn follow:

Anomalous OMS-1:

A bad OMS-1 burn could result in an Abort-Once-Around (AOA) or an Abort-To-Orbit (ATO).

SUPPORT: Since OMS-1 occurs during the earliest part of the flight, the b5

The JSC/FDO will pass the abort determination to the SSC as well as the choice of primary landing site. The SSC should then determine what sensors will cover the abort.

CHECKLIST:

Abort-Once-Around (AOA):

1. b5

2. b5

3. b5

Should NASA press for an OMS-2 burn after a bad OMS-1 (ATO), the JSC/FDO should pass the new proposed OMS-2 vector to the SSC. The OAL should re-run COMBO for the planned OMS-2 nominal and the SSC will pass the new conjunction results to the JSC/FDO. The SVO should then run a new PASCHED. The

SSC will voice-task sensors and request the data be sent Flash precedence (or equivalent) to the SCC, ASCC and BCP. ADCOM support then resumes at the normal OMS-2 point.

CHECKLIST:

Abort-To Orbit (ATO):

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

7. b5

Anomalous OMS-2:

A bad OMS-2 burn could result in an early deorbit.

SUPPORT: Should the OV have no OMS-2 burn, JSC/FDO will pass an early deorbit time and landing site to the SSC as soon as JSC makes the decision. The SSC should determine acquiring sensors and have track data sent to the SCC, ASCC, and DCF, Flash precedence (or equivalent).

CHECKLIST:

OMS-2 No Burn:

1. b5

2. b5

Should the OV have an incomplete OMS-2 burn, the JSC/FDO will pass the SSC a new state vector and injection time. The OAL should enter the new vector into the system and re-run COMBO. The SVO will run a new PASCHED. The JSC/FDO will inform the SSC if the OV will deorbit at a later time or attempt to reach the OMS-2 orbit with a successive burn.

CHECKLIST:

OMS-2 Incomplete Burn:

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

7. b5

8. b5

Anomalous OMS-3:

A bad OMS-3 burn could require a change to the OMS-4 vector. Early deorbit could result.

SUPPORT: Should the OV have no OMS-3 burn, there should be no other requirement than to run COMBO for the extended OMS-2 orbit. The SSC should ask the JSC/FDO if there will be another OMS-3 attempt or an early deorbit.

CHECKLIST.

OMS-3 No-Burn:

1. b5

2a. b5

2b. b5

2c. b5

2d. b5

3a. b5

3b. b5

3c. b5

3d. b5

3e. b5

3f. b5

4. b5

Should the OV have an incomplete OMS-3 burn, the JSC/FDO should pass the new OMS-4 vector to the SSC. The OAL should enter the vector into the system via IONORB and re-run COMBO. The SVO should run a new PASCHED. The SSC should pass any new conjunction results to the JSC/FDO. ADCOM support then resumes at the OMS-3 point.

<u>OMS-3 Incomplete Burn:</u>

1. b5

2. b5

3. 65

4. 65

5. 65

6. 65

Anomalous OMS-4:

A bad OMS-4 could require a change to the Deorbit vector.

SUPPORT: The SSC should find out if the OV is going to deorbit early from the JSC/FDO. If so the JSC/FDO should pass a new vect r, landing site and deorbit time to the SSC. The OAL will enter the new vector into the system and re-run COMBO. The SVO will run a new PASCHED. The SSC should begin flight termination actions when appropriate.

If the OV is going to power-down and reenter later than planned (i.e. past rev 36), the OAL should run COMBO for the extended OMS-4 orbit and the new deorbit vector once acquired from the JSC/FDO. The SSC should begin the flight termination procedures when appropriate.

CHECKLIST:

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

7. b5

8. b5

"Events" during OV flight:

Events include launch of non-allied boosters and maneuvers of non-allied payloads, or any other potential threat action.

SUPPORT: Any event while the OV is in orbit should be analyzed to determine if the event poses a threat to the OV. The OAL should run COMBO between appropriate orbits to aid in making this determination. The SDD should interact according to established SPADOC procedures. Any potential threat should be passed to JSC immediately to allow time to maneuver the OV and avoid the potential threat if deemed necessary.

CHECKLIST:

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

7. b5

8. b5

9. b5

10. b5

D. DEORBIT/LANDING:

Anomalous Deorbit:

A bad deorbit (D/O) burn could affect the reentry of the OV or extend the mission length.

SUPPORT: Should there be no deorbit burn, the OV will remain in the OMS-4 orbit. The SSC will find out from the JSC/FDO if and when the OV will again attempt to deorbit. JSC may elect to power-down the OV and wait 24 hours or longer for another optimum deorbit opportunity. In this case the A/SVO will pass this information to the ASCC and the BCP, the OAL will run a 30-hour COMBO and the SSC will pass new conjunction results to the JSC/FDO. The SVO should run a new PASCHED for the same time to determine who will track the OV and assure it is well tracked while awaiting the second deorbit attempt. All actions should be accomplished for all missed deorbit attempts.

CHECKLIST:

D/O No-Burn:

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

Should there be an incomplete D/O burn, the OV may re-enter on a shallower trajectory. This may require the SSC to pass any acquisition data to the JSC/FDO so the JSC/FDO can begin arrangements for a possible CLS landing. Furthermore, the MWO may need to alert MW units of the nature of the OV reentry in case of L&I generation.

D/O Incomplete Burn:

1. b5

2. b5

3. b5

4. b5

5. b5

6. b5

Anomalous Reentry of OV:

An anomalous reentry of the OV could result in a breakup in the Earth's atmosphere.

SUPPORT: Should the OV reenter in a hybrid or uncontrolled state, it is probable that the OV would tumble and break up much like any other reentering satellite. The SSC would perform the standard actions required for any TIP object to include determination of the impact point or footprint, piece counts, and OPREP 3 reporting if necessary.

CHECKLIST:

1. b5

2. b5

3. b5

E. OTHER:

JSC/MCCR Outage:

A degradation of JSC computational or command and control capability could be potentially hazardous to Shuttle operations.

SUPPORT: The probability of JSC losing computational capability is extremely remote due to their ability to reconfigure their many redundant backup computers. However, should some unforeseen circumstance occur whereupon JSC loses the capability to support the OV flight, they would transfer computational responsibility to Goddard Space Flight Center (GSFC). As long as JSC has comm capability, they retain command and control; however, should this be lost, Goddard takes command and control of the OV as well. At the point where Goddard assumes computational responsibility, ADCOM

will go into a dual-support role passing SCC data to both JSC/MOCR and GSFC/MCC. If JSC loses comm as well, ADCOM support will transfer solely to GSFC. The OV will deorbit at the earliest opportunity.

CHECKLIST:

JSC Loses Computational Capability:

1. b5

2. b5

3. b5

JSC Loses C^3:

1. b5

2. b5

3. b5

DoD Directive to Restrict Tracking of OV:

A possibility exists that NASA may request, through the appropriate DoD channels, that ADCOM be directed to restrict tracking of the OV during all or a portion of the OFT-1 mission.

SUPPORT: Should ADCOM be directed by DoD to restrict tracking of the OV during all or a portion of the OFT-1 mission, then ADCOM sensors will be notified in accordance with the methods listed below. Note: Should this contingency arise, all planned support should continue within the constraints of restricted tracking.

CHECKLIST:

1.

b5

2.

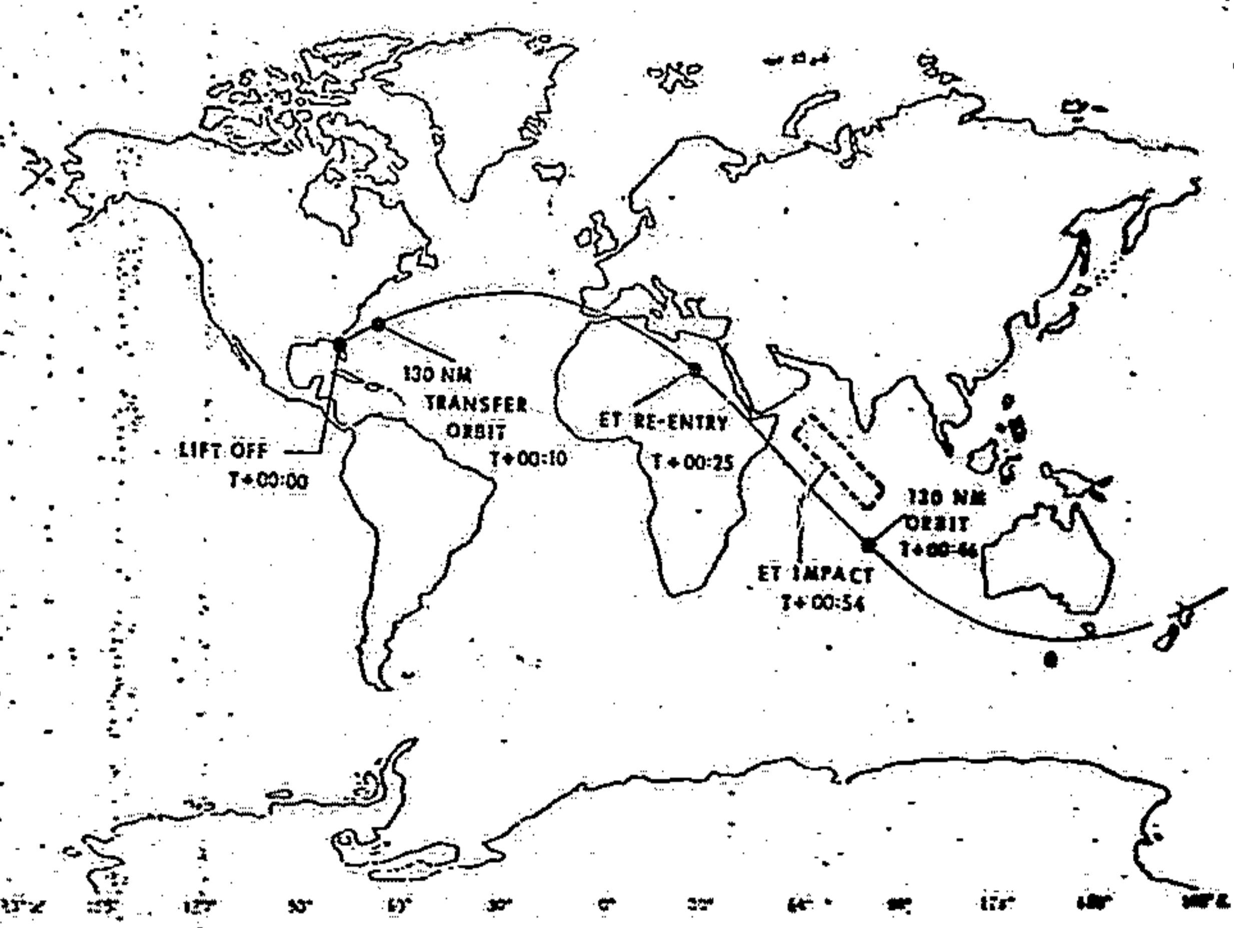
b5

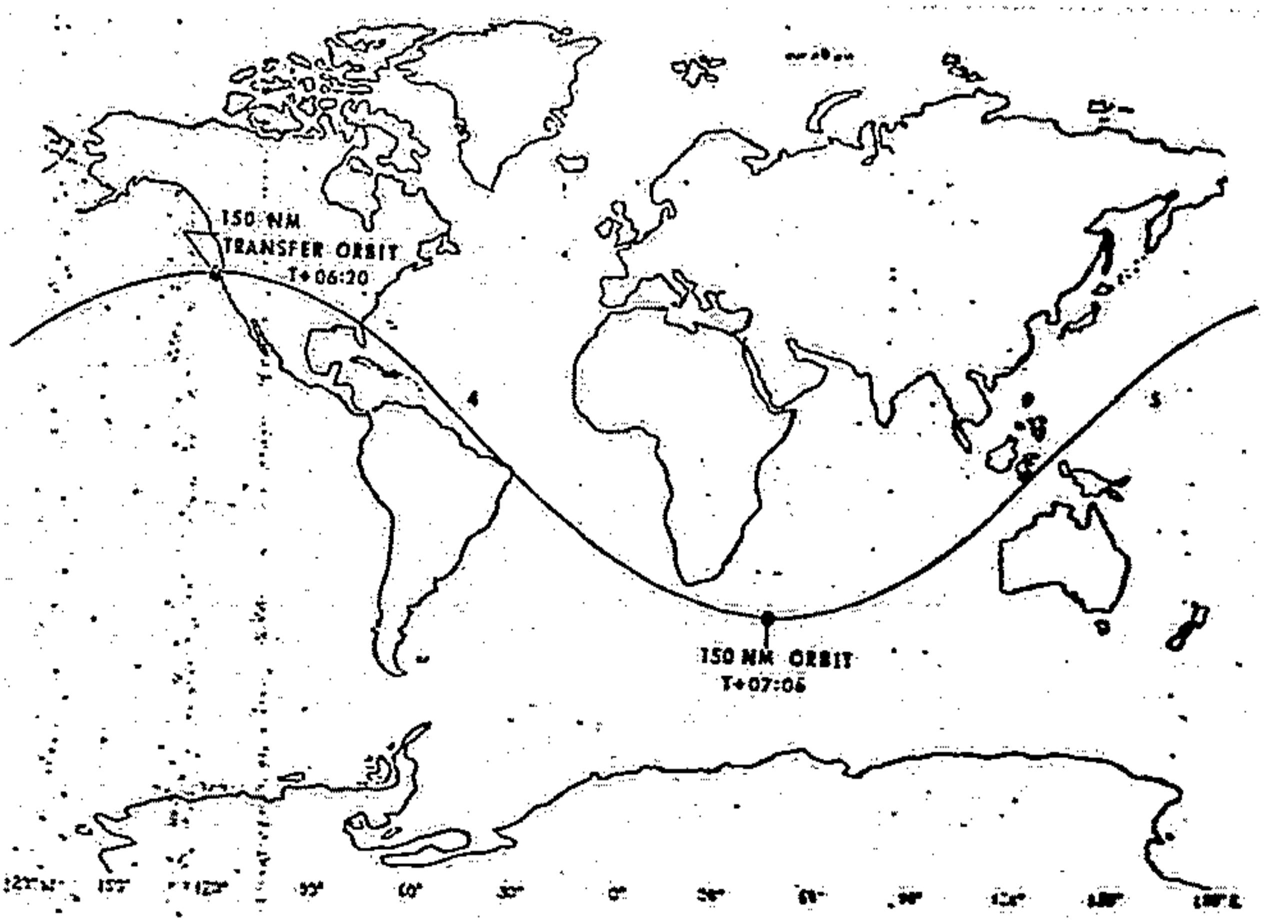
3.

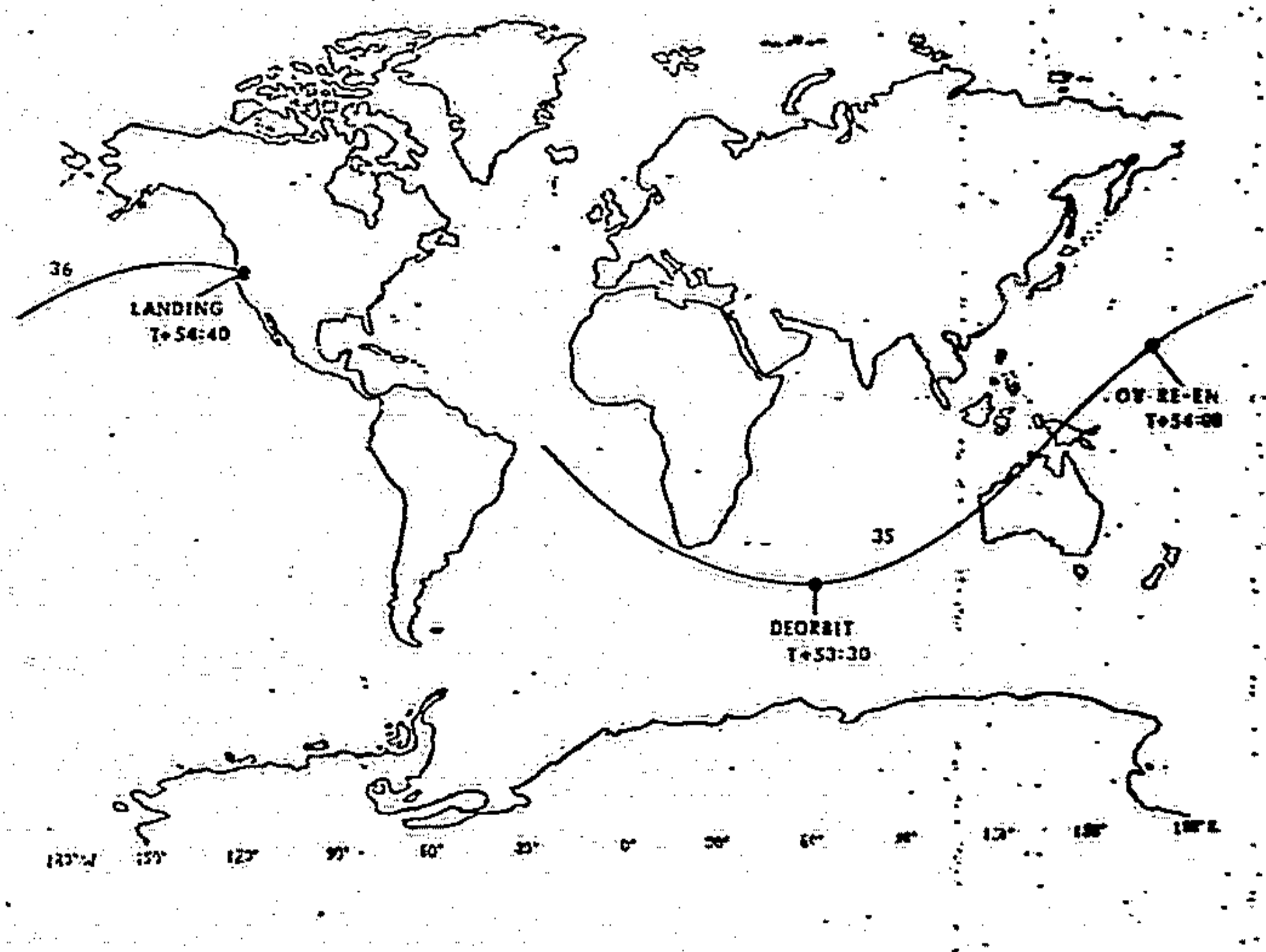
b5

APPENDIX 1

OPT-1 GROUND TRACES


130 NM
TRANSFER
ORBIT
T+00:10
LIFT OFF
T+00:00
ET RE-ENTRY
T+00:25
130 NM
ORBIT
T+00:46
ET IMPACT
T+00:54


150 NM
TRANSFER ORBIT
T+06:20
4
5
150 NM ORBIT
T+07:06
60°
30°
0°


36
LANDING
T+54:40
35
DEORBIT
T+53:30
OV-RE-EN
T+54:00
0°

APPENDIX 2

SPECIAL SUPPORT CRITERIA

APPENDIX 2 TO CINCAD IMPLEMENTATION PLAN 3410-81

SPECIAL SUPPORT CRITERIA

A. <u>COMPUTATION OF MISS BETWEEN ORBITS (COMBO):</u>

<u>Cases*</u>

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B. CONFERENCES:

1. Early Orbit Determination (EODET):

The EODET conference will be virtually the same in that the SVO will be obtaining TEARR data from the acquiring sensors for the launch agency. However, EODET is usually requested in the ILAM; in the case of the Space Shuttle, this support has already been requested in a separate requirements letter. JSC will not require the information unless the S-Band tracker in Madrid, Spain is dysfunctional. If this is the case, JSC will come to ADCOM requesting EODET support at which time the TEARR data will be passed.

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. The sensors to be tasked for EODET will be given to the SVO by the Space Analysis and Data Division Launch Analyst.

2. <u>Launch Correlation Unit (LCU):</u>

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3. <u>Flight Termination Conference (FTC):</u>

The FTC is a new concept among conferences because the U.S. has never had an orbiting vehicle or satellite capable of controlled reentry; for the Space Shuttle, the SVO will task KWJ to scan the D/O vector and pass where the OV is in relation to it. b5 ; however, the OV is a lifting body and not in an exact ballistic trajectory, so this data should be analyzed with these points in consideration.

C. <u>TIP:</u>

Project TIP will be implemented to support prediction of where the ET will impact after separation from the OV. This will become especially important if the ET attains an extended ballistic trajectory or a fractional or multiple orbit as a

result of an overburn/overspeed condition.

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Therefore, the impact point should be analyzed with this point in consideration. TIP should also be run for any stable OV orbit.

APPENDIX 3

AGENCY/PERSONNEL DIRECTORY

APPENDIX J TO CINCAD OPLAN 3410-81 IMPLEMENTATION PLAN

AGENCY/PERSONNEL DIRECTORY

The following will be disseminated <u>only</u> to those agencies and personnel whose official duties specifically require knowledge of this information. Strict compliance to the above is mandatory.

A. TELEPHONE NUMBERS

Agency	Duty
A/J-3Y	NCMC x3510
A/J-3YYA	NCMC x3510
A/J-3YYD	NCMC x3510
ADCOM Public Affairs	635-8911 x4696
FDO (NASA)	Contact A/SSC for restricted number
TRACK (NASA)	Contact A/SSC for restricted number
Comm Control (NASA)	Contact A/SSC for restricted number

B. MESSAGE ADDRESSES

Until Jan 82 use

Ø NAS to route data through GSFC to JSC

After Jan 82 use

Ø JON to pass data to JSC/MOCP

APPENDIX 4

DISTRIBUTION

HQ ADCOM	No. of Copies	HQ ADCOM	No. of Copies
J-1X	1	J-3T	5
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J-31C	3	J-4X	1
J-31D	3	J-5C	1
J-31E	3	J-5D	1
J-36	2	J-5Y	1
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J-3F	2	J-6T	1
J-3G	3	PA	1
J-3S	2		

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6 MWS, OTIS AFB, MA	2
7 MWS, BEALE AFB, CA	2